Description

Throttle valve device

The invention relates to a throttle valve device as claimed in the preamble of claim 1.

Known throttle valve devices, particularly electrically operable throttle valve devices for internal combustion engines, have a throttle valve housing in which a throttle valve for varying a flow cross section for a gas is pivotally mounted. In some cases the throttle valve is implemented in an electrically drivable manner. For tolerance reasons, the throttle valve housings of known throttle valve devices are generally made of metal or a thermosetting plastic. The throttle valve housing is sealed by a cover which serves on the one hand to cover a drive casing and, on the other, constitutes a counter bearing for a throttle valve shaft in the region of a passage cross section of the throttle valve device. Both the throttle valve housing and the throttle valve cover have fixing means whereby the throttle valve device can be mounted on an upstream air filter device and on a downstream intake pipe device. The disadvantage of known throttle valve devices of this kind is that the time and effort of mounting the throttle valve device in the intake tract of an internal combustion engine is costly. Moreover, increased sealing complexity is required.

The object of the invention is to create a throttle valve device which significantly reduces the assembly cost of an

intake tract of an internal combustion engine while at the same time meeting the requirements placed on a throttle valve device in respect of long service life, moisture resistance and dimensional stability. In addition, the throttle valve device is to be easily manufacturable using few components and in an inexpensive manner.

This object is achieved with a throttle valve device having the features set forth in claim 1. A throttle valve device according to the invention has at least two housing parts and a throttle valve, one of said housing parts having a throttle pipe section which cooperates with the throttle valve, the other housing part forming a monolithic part with at least one upstream or downstream duct section. Advantageous embodiments are set forth in the sub-claims.

According to the invention it was recognized that only the throttle valve housing in which the actual throttle valve is mounted and in which stop edges for the throttle valve are formed needs to be made of metal and/or a thermosetting plastic. According to the invention, the cover of the inventive throttle valve device is made from an essentially less expensive thermoplastic material. In addition, at least one intake pipe section is of a piece with the cover of the throttle valve device. This allows at least a shift of the mounting plane between the throttle valve device and a downstream intake pipe, ideally even the elimination of such a mounting plane, i.e. if the intake pipe is of a piece with the throttle valve cover.

This has the considerable advantage of enabling the location of the mounting plane between the throttle valve device and downstream and/or upstream intake pipe elements to be more freely selected, thereby achieving greater degrees of freedom in the constructional design. In the ideal case a mounting plane can be dispensed with completely.

The invention will now be explained in greater detail using examples and with reference to the accompanying drawings in which:

Figure 1: shows a perspective view of throttle valve device according to the invention;

Figure 2: shows a further view of a throttle valve device according to the invention from a different perspective from Figure 1 so as to make the interior of the intake pipe section visible; and

Figure 3: shows a side elevation of the throttle valve device according to the invention as shown in Figures 1 and 2.

An inventive throttle valve device 1 (Figures 1 to 3) has a throttle valve housing 2 and a throttle valve housing cover 3.

The throttle valve housing 2 has throttle pipe section 4 and a drive casing section 5. The throttle valve housing cover 3 has a drive casing cover section 6 which is connected to a pipe flange 7.

The drive casing section 5 and the drive casing cover section 6 form a parting line 8 which divides approximately symmetrically the drive casing comprising the drive casing section 5 and the drive casing cover section 6.

The throttle pipe section 4 of the throttle valve housing 2 and the pipe flange 7 of the throttle valve housing cover 3 form a second parting line 9. The second parting line 9 is disposed at an angle to the first parting line 8 so that the sealing surfaces forming the parting lines 8, 9 of the throttle valve housing 2 and of the throttle valve housing cover 3 meet in the region between the drive casing 5, 6 and a throttle pipe 10 consisting of the throttle pipe section 4 and the pipe flange 7, forming a kink.

At the transition from the drive casing 5, 6 to the throttle pipe 10, the position of the parting line is selected such that a throttle valve shaft 11 of a throttle valve 12 is pivotally mounted via a bearing recess in the throttle valve housing cover 3 and in the throttle valve housing 2. At an opposite end of the throttle valve shaft 11 the latter is mounted only in a suitable recess inside the throttle pipe section 4 in such a way that the pipe flange 7 is not involved in supporting the throttle valve shaft 11 there. This means that it is possible to preassemble the entire drive (not shown) and the throttle valve 12 together with the throttle valve shaft 11 only in the throttle valve housing 2, so that by placing on and fixing the throttle valve housing cover 3 by means of fixing elements such as mounting clips, mounting surfaces 13 and/or bolts (not shown), fixing can be performed on the throttle valve housing 2

and therefore the drive casing is sealed and the throttle valve 11 is pivotally mounted in the throttle pipe 10.

It is particularly advantageous here that all the relevant dimensional tolerances for installing the drive and in particular for installing the throttle valve 12 or more precisely for supporting the throttle valve, and the surfaces of the throttle pipe section 4 cooperating with throttle valve edges, are all provided in a single housing part, i.e. specifically in the throttle valve housing 2. The throttle valve cover 3 thus only has a covering function and need not therefore meet such stringent requirements in terms of dimensional accuracy, dimensional tolerances and dimensional stability, particularly due to moisture ingress, as the throttle valve housing 2.

For the throttle valve housing 2 in which the throttle gaps between the throttle valve 12 and the throttle pipe section 4 exist, this is of great importance, as even small variations in gap dimensions or more precisely the creation of gaps of smaller cross section can have a significant effect on the supply or more precisely the mixture formation for an internal combustion engine.

Therefore the throttle valve housing 2 is preferably made of metal or a thermosetting plastic, as these materials are capable of maintaining the required tolerances even over lengthy periods of time, particularly when subjected to moisture or strongly fluctuating temperature effects. According to the invention it was now recognized that it is possible, by

reducing the function of the throttle valve housing cover 3 to merely a covering function, to make it from a less expensive material, particularly from a plastic which can be processed in an injection molding process.

For this purpose thermoplastic materials in particular, such as PA 6, PA 6.6, PA 4.6 or thermoplastic mixed plastics, have proved suitable according to the invention. As due to material selection the throttle valve housing cover 3 can be manufactured using conventional injection molding methods, there is disposed in the region of the pipe flange 7 at least one sub-region of an intake pipe, i.e. at least one intake pipe section 15 which is disposed in a flow direction 16 e.g. upstream of the throttle pipe section 4 is of a piece with the throttle valve housing cover 3. Preferably the intake pipe usually disposed between the throttle valve device 1 and the engine or rather its intake manifold is connected as a whole, as a single piece, to the throttle valve housing cover 3.

This measure means that there is one less joining plane between an intake pipe and the throttle valve device 1. If an intake valve section 15 is formed on the throttle valve housing cover 3, this allows a freer selection of the mounting plane to the component following the intake pipe section 15 depending on the length of the intake pipe section 15 and the shape of the intake port section 15 in respect of its tubular characteristics. The intake pipe section 15 or rather the intake pipe is essentially cylindrically tubular and is characterized in that it has no interaction surfaces with the throttle valve 12 or rather its boundary edges.

In the throttle valve device according to the invention it is particularly advantageous that a target conflict has been resolved such that a cost reduction could be achieved by reducing the number of components while at the same time providing greater constructional design freedom. It is further advantageous that the leak-proneness and therefore the reliability of the entire throttle valve device 1 in interaction with downstream components is considerably improved, because a sealing plane or rather a parting plane with associated fixing devices can be dispensed with.